What is claimed is:

1. A zirconia-alumina nano-composite powder formed of secondary particles prepared by sintering in nano-scale of zirconia having a primary particle diameter of 10-50 nm and alumina having a primary particle diameter of 10-100 nm.

2. The zirconia-alumina nano-composite powder of claim 1, wherein a weight ratio of the zirconia to the alumina is in the range of 99.9:0.1 to 50:50.

3. The zirconia-alumina nano-composite powder of claim 1, further containing an oxide of at least one metal selected from the group consisting of yttrium, magnesium, calcium, cerium, niobium, scandium, neodymium, plutonium, praseodymium, samarium, europium, gadolinium, promethium, and erbium.

4. The zirconia-alumina nano-composite powder of claim 3, wherein the molar ratio of the oxide of at least one metal to the zirconia is in the range of 0.0001:1 to 20:1.

5. A method of preparing the zirconia-alumina nano composite powder of claim 1, the method comprising:

mixing a mixed solution of a polyhydric alcohol and a carboxylic acid and a mixed solution of a zirconium salt and an aluminum salt;

heating the resulting mixture at 100-300℃ to produce a polyester network structure where zirconium ions and aluminum ions are captured; and

calcining the resuling polymer network structure at 400-1000℃.

6. The method of claim 5, wherein the polyhydric alcohol is selected from the group consisting of ethyleneglycol, propyleneglycol, diethyleneglycol, triethyleneglycol, dipropyleneglycol, hexyleneglycol, butyleneglycol, glycerol, hydroquinone (p-dioxybenzene), catechol (1,2-dihydroxybenzene), resorcinol (resorcine or 1,3-dioxybenzene), pyrogallol (1,2,3-trihydroxybenzene), 5-hydroxymethylresorcinol (3,5-dihydroxybenzyl alcohol), phloroglucinol (1,3,5-trihydroxy benzene), and dihydroxybiphenol.

7. The method of claim 5, wherein the carboxylic acid is selected from the group consisting of a citric acid, a benzenetricarboxylic acid, a cyclopentatetracarboxylic acid, an adipic acid (1,4-butanedicarboxylic acid), a maleic acid (1,2-ethylenedicarboxylic acid), an oxalic acid, an succinic acid, a tartaric acid (dioxysuccinic acid), a mesaconic acid (methyl fumaric acid), a glutaric acid (n-pyrrotartaric acid), a malonic acid, a glycolic acid, a malic acid, a lactic cid, a gluconic acid, a fumaric acid, a phthalic acid (o-benzenedicarboxylic acid), an isophthalic acid (m-benzenedicarboxylic acid), a terephthalic acid, an m-hydroxybenzoic acid, a p-hydroxybenzoic acid, a salicylic acid (o-hydroxybenzoic acid), an itacnic acid (methylenesuccinic acid), a citraconic acid, an aconitic acid, a galic acid, a hydroxyethylehtylenediaminetriacetic acid (HEDTA), an ethyleneglycoltetraacetic acid (EGTA), an ethylenediaminetetraacetic acid (EDTA), glutamic acid, an aspartic acid, and an ethylenediaminetetrapionic acid.

8. The method of claim 5, wherein each of the zirconium salt and the aluminum salt is one of a chloride, a nitrate, and a hydroxide thereof.

9. The method of claim 5, wherein the mole ratio of the polyhydric alcohol and the carboxylic acid is in the range of 10:90 to 90:10.

10. The method of claim 5, wherein the mixed solution of a zirconium salt and an aluminum salt further comprises at least one metal salt selected from the group consisting of an yttrium salt, a magnesium salt, a calcium salt, a cerium salt, a cerium salt, a niobium salt, a scandium salt, a neodymium salt, a plutonium salt, a praseodymium salt, a samarium salt, an europium salt, a gadolinium salt, a promethium salt, and an erbium salt.

11. The method of claim 5, wherein the weight ratio of the zirconia-alumina nano-composite powder prepared using a zirconium salt and an aluminum salt to the mixed solution of a polyhydric alcohol and a carboxylic acid is in the range of 10:1 to 10:999.9.

12. A sintered zirconia-alumina composite obtained by sintering the zirconia-alumina nano-composite powder of any one of claims 1 through 4 at 1300 to 1500℃.